

AMENDMENTS TO CLAIMS

The listing of claims below replaces prior versions of claims in the application. Claims 1-24 are the originally filed claims. Claims 13, 15 and 16 have been cancelled. Claims 1-12, 14, and 17-19 have been amended. Claims 1-12, 14 and 17-24 are now pending.

Listing of Claims:

1. (Currently Amended) A computer-readable medium apparatus having computer-executable instructions for performing ephemeral garbage collection, the computer-readable medium apparatus being accessible by a computing device, the instructions comprising:

requesting a list from a tracking mechanism, the list identifying a plurality of memory locations that have been accessed since the last ephemeral garbage collection, each memory location corresponding to one of a plurality of cards associated with a card table, wherein the card table identifies one or more cards with one or more objects that have been accessed, each card being associated with the one or more objects allocated from within a memory heap;

creating a bundle table identifying a plurality of bundles, wherein each bundle identifies groupings of subsets of the plurality of cards;

identifying-updating bundles at least one marked bundle by marking two or more of the plurality of bundles in the table using based on the list, wherein the updated marked bundle corresponds to marked cards in the marked bundle that represents a subset of the plurality of cards having associated objects that have been accessed since a last garbage collection process;

for each marked bundle in the bundle table, determining at least one marked card within the marked bundle;

for each marked card, determining at least one accessed object within the marked card; and

performing garbage collection upon the at least one accessed object.

2. (Currently Amended) The computer-readable medium apparatus of claim 1, wherein the tracking mechanism comprises a write-watch mechanism.

3. (Currently Amended) The computer-readable medium apparatus of claim 2, wherein the write-watch mechanism operates within a memory manager.

4. (Currently Amended) The computer-readable medium apparatus of claim 2, wherein the write-watch mechanism records a first access to the memory location.

5. (Currently Amended) The computer-readable medium apparatus of claim 1, wherein the list comprises a bitmap and each bit within the bitmap corresponds to one of the plurality of cards.

6. (Currently Amended) The computer-readable medium apparatus of claim 2, wherein the list of memory locations is maintained in response to a request from the ephemeral garbage collection process.

7. (Currently Amended) The computer-readable medium apparatus of claim 1, further comprising resetting the list of memory locations.

8. (Currently Amended) The computer-readable medium apparatus of claim 1, wherein the subset of cards corresponds to a number of cards that are tracked using a page of memory storing the card table.

9. (Currently Amended) The computer-readable medium apparatus of claim 1, wherein identifying the marked bundle comprises marking a bit associated with the marked bundle table within a bundle bitmap based on the memory locations within the list.

10. (Currently Amended) The computer-readable medium apparatus of claim 9, wherein marking the bit comprises setting the bit.

11. (Currently Amended) The computer-readable medium apparatus of claim 1, wherein determining the at least one marked card comprises scanning a card bitmap having a bit for each of the plurality of cards, the bit for each marked card being different than another bit associated with one of the cards that was not accessed.

12. (Currently Amended) A method for executing statements within a program to support ephemeral garbage collection, the method comprising:
specifying a range of card table memory to watch during program execution by calling a write-watch mechanism that performs tracking of the access to the card table memory and maintains a write-watch list that identifies cards

accessed within the card table memory since a garbage collection process was last performed, the card table memory identifying prior access to a plurality of cards, each card being associated with and updated upon access to one or more objects allocated within a memory heap, the memory heap being divided into the plurality of cards with each card being grouped into one of a plurality of bundles, wherein one of the plurality of bundles corresponds to a subset of that plurality of cards that are tracked using a page of card table memory; and

creating one or more bundle tables identifying groupings of the cards in the plurality of bundles;

for each store statement within the program, storing a value at a memory location within the heap memory based on the store statement, marking one of the plurality of cards within the card table memory based on the memory location, and tracking access to the card table memory;

updating at least one bundle table by marking the bundle table based on information obtained from the write-watch list, wherein the updated marked bundle table corresponds to marked cards having associated objects that have been accessed since a last garbage collection process;

for each marked bundle table, determining at least one marked card within the marked bundle table;

for each marked card, determining at least one accessed object within the marked card; and

performing garbage collection upon the at least one accessed object.

13. (Cancelled).

14. (Currently Amended) The method of claim ~~13~~12, wherein the write-watch mechanism resides within a memory manager and sets bits in the card table upon access to at least one of the plurality of cards.

15. (Cancelled)

16. (Cancelled)

17. (Currently Amended) The method of claim ~~16~~12, wherein an ephemeral garbage collection process requests the write-watch list when performing a garbage collection cycle.

18. (Currently Amended) The method of claim ~~16~~12, wherein the ephemeral garbage collection process determines a marked bundle based on the write-watch list.

19. (Currently Amended) A system for performing ephemeral garbage collection, the system comprising:

a processor; and

a memory into which a plurality of instructions are loaded and into which a plurality of objects are dynamically allocated, the memory having a heap into which the objects are allocated, the heap being divided into a plurality of cards which are grouped into a plurality of bundles, each card being associated with one or more of the plurality of objects; wherein upon execution of the plurality of instructions by the processor, the system being configured to:

request a list from a tracking mechanism, the list only identifying memory locations that have been written into since a last garbage collection cycle, each memory location corresponding to one of the plurality of cards associated with a card table, wherein the card table identifies one or more cards that have been accessed;

creating one or more bundle tables wherein each bundle table identifies groupings of the plurality of cards in the plurality of bundles;

identify ~~updating~~ at least one ~~marked~~ bundle table by marking bundles within the bundle table based on the list, wherein the marked bundles corresponds to marked cards ~~that represents a subset of the plurality of cards~~ having associated objects that have been accessed since a last garbage collection process;

determine, for each marked bundle within the bundle table, at least one marked card within the marked bundle, the at least one marked card indicating that one or more objects associated with the marked card ~~has~~ have been accessed;

determine, for each marked card, the one or more objects that has
have been accessed; and

perform garbage collection upon the one or more accessed objects.

20. (Previously Presented) The system of claim 19, wherein the tracking mechanism comprises a write-watch mechanism.

21. (Previously Presented) The system of claim 20, wherein the write-watch mechanism resides within a memory manager and sets bits in the card table upon access to at least one of the plurality of cards.

22. (Previously Presented) The system of claim 19, wherein the subset of cards corresponds to a number of cards that are tracked using a page of memory storing the card table.

23. (Previously Presented) The system of claim 19, wherein the marked bundle being identified by a marked bit associated with the marked bundle within a bundle bitmap based on the list.

24. (Previously Presented) The system of claim 19, further comprising setting a bit in the card table to identify one or more cards that have been accessed.